V. Note by Professor Cayley on his Memoir "On the Conditions for the Existence of Three Equal Roots, or of Two Pairs of Equal Roots, of a Binary Quartic or Quintic." Received February 20, 1869.

The title is a misnomer; I have in fact, in regard to the quintic, considered *not* (as according to the title and introductory paragraph I should have done) the twofold relations belonging to the root-systems 311 and 221 respectively, but the threefold relations belonging to the root-systems 41 and 32 respectively. The word "quadric," p. 582, line 1, should be read "cubic." The proper title is, "On the Conditions for the Existence of certain Systems of Equal Roots of a Binary Quartic or Quintic."

March 4, 1869.

Lieut.-General SABINE, President, in the Chair.

In accordance with the Statutes, the names of the Candidates for election into the Society were read as follows:—

Sir Samuel White Baker, M.A.
William Baker, C.E.
John J. Bigsby, M.D.
Francis T. Buckland, M.A.
George William Callender, F.R.C.S.
Charles Chambers.
Walter Dickson, M.D.
Henry Dircks.
Sir George Floyd Duckett, Bart.
William Esson, M.A.
Alexander Fleming, M.D.
Prof. George Carey Foster, B.A.
Peter Le Neve Foster, M.A.
William Froude, M.A., C.E.
Edward Headlam Greenhow, M.D.
William Withey Gull, M.D.
G. B. Halford, M.D.
Townshend Monckton Hall.
Edmund Thomas Higgins, M.R.C.S.
Charles Horne.
James Jago, M.D.
George Johnson, M.D.
J. Norman Lockyer.
James Atkinson Longridge, C.E.
John Robinson M'Clean, C.E.
George Matthey.
St. George Mivart.
Prof. Alfred Newton, M.A.
Captain Sherard Osborn, R.N., C.B.
Oliver Pemberton.
Charles Bland Radcliffe, M.D.
William Henry Ransom, M.D.
Theophilus Redwood, Ph.D.
John Russell Reynolds, M.D.
Vice-Admiral Sir Robert Spencer Robinson, K.C.B.
Major James Francis Tennant, R.E.
Edward Thomas.
Prof. Wyville Thomson, LL.D.
Col. Henry Edward Landor Thuillier, R.A.
Cromwell Fleetwood Varley, C.E.
Augustus Voelcker, Ph.D.
Edward Walker, M.A.
George Charles Wallich, M.D.
Henry Wilde.
Samuel Wilks, M.D.

I. "Appendix to the Description of the Great Melbourne Telescope." By T. R. Robinson, D.D., F.R.S., &c. Received February 10, 1869.

(Abstract.)

Since this paper was read the author has made several observations of the quantity of light transmitted by object-glasses, and determined the index of absorption in various specimens of glass. The results of some of these are in accordance with the opinion expressed in the paper; but others present a difference which is very satisfactory as indicating a surprising progress in the manufacture of optical glass. The observations were made by means of Zöllner's photometer.

The following results were obtained for the intensity of the light transmitted by a variety of object-glasses:—

Description.	Aperture.	Focus.	Intensity.
	in.	in.	
a. Triple object-glass	2·75	48	0·5497
b. Double	3·80	63	0·5962
c. Double	3·25	48	0·6567
d. Double	6·50	96	0·6772
e. Double	5·50	...	0·7928
f. Double, inner surface cemented	5·00	...	0·8739
g. Double, cemented	12·00	224	0·8408
h. Double	3·20	...	0·7393

Of the above, *a* belongs to the Armagh Observatory; it is by one of the Dollonds, older than 1790, and is probably one of their first attempts at a triple combination. *b* is the original object-glass of the Armagh circle; it was made by Tulley about 1828; the crown is greenish, and is supposed to be English; the flint is believed to have been from Daguet. *c* was made for the author by Tulley in 1838; its glass is French, the crown is greenish. *d* is by Cauchoix; the crown is greenish, and has probably a high n, but its mean thickness is only 0·39. *e* is by Messrs. Cooke; the glass is Chance's. *f* is by Grubb, the glass Chance's: the very high transmission of this lens is in part due to the cementing of the adjacent surfaces, which, while it makes more difficult the correction of spherical aberration, removes almost entirely the reflection at a surface of crown and one of flint: the factor for this $=0·9036$; and if the I be multiplied by this, we obtain 0·7806, nearly that of *e*, the difference being due to the reflection at the film of cement. *g* is also by Grubb, and cemented; the glass is by Chance. *h* is by Fraunhofer.

On examining this Table the progressive increase in the light of the object-glasses is evident. The first two, which may be considered good specimens of the early achromatics, have less illuminating-power than the Herschelian reflector. A great advance was made by Guinand and those who followed in his steps; and a still greater one by Chance, whose glass is nearly perfect as to colour and transparency.

The same inference follows from the author's measure of the index of

absorption, n. The specimens examined were, with two exceptions, prisms; and this form is very convenient. If a ray is incident on an isosceles prism parallel to its base, it emerges parallel to itself after undergoing total internal reflection at the base; and the length of the path of the light within the glass, and the loss by the two reflections, are easily calculated from the known angle and refractive index. The mean index used in the calculation was that of the line E.

The results are given in the following Table, in which are introduced those given in the paper that they may be referred to at once; and there is added to them one found in Bouguer's 'Traité d'Optique,' which seems trustworthy.

	Description.	n
1.	Prism, originally Captain Kater's	0·1829
2.	French plate, Mr. Grubb	0·1728
3.	London plate, Mr. Grubb	0·2140
4.	Two of same, Mr. Grubb	0·1446
5.	Prism, Mr. Grubb	0·0617
6.	Bouguer's glass	0·1895
7.	Gassiot's prisms	0·6209
8.	Prism by Dubosq, flint	0·1504
9.	Prism by Merz, flint	0·1089
10.	Prism by Merz, crown	0·0858
11.	Prism by Merz, flint	0·1065
12.	Prism by Grubb	0·0218
13.	Cylinder of crown	0·0272
14.	Cylinder of flint	0·0090

No. 1 was shown to the author in 1830 by Captain Kater, as the *chef-d'œuvre* of the Glass-Committee; he used it as the small speculum of his Newtonian. Afterwards it came into the possession of the late Lord Rosse, who made the above measures with Bunsen's photometer in 1848. It is English plate, greenish.

Nos. 2, 3, 4, 5 were measured by Mr. Grubb in 1857. No. 5 was a prism of 90°. He does not remember its history; but evidently it was of Chance's glass.

No. 6 is described by Bouguer as "glace," 3 Paris inches thick. It was probably that of St. Gobain, which has probably not varied in composition, and *its* μ has been used in the computation.

No. 7 consists of two prisms of 60°, which Mr. Gassiot, with his wonted kindness, intrusted to the author for some inquiries about the improvement of the spectroscope. They are by Merz, of glass which seems nearly identical with Faraday's dense glass, having a specific gravity of 5·1, and a mean $\mu = 1{\cdot}7664$. It is very pellucid, but, like its prototype, has a yellowish tinge, probably given by the large proportion of lead. As Merz does not polish the base or ends of his prisms, the usual method could not be employed; but the prisms were put together with the angles opposed, and a drop of olive-oil between, and the reflections allowed for. The great

absorption is remarkable, and apparently cannot be explained by the colour of the glass.

No. 8 is of 60°; its μ for E=1·620. It is free from colour, and an evident improvement on the earlier ones.

No. 9, a prism of 90°, was given to the author by Dr. Lloyd for a small mirror in the Newtonian form of the Armagh 15-inch reflector; its μ for E=1·6188.

No. 10, of 90°, was obtained by the late Lord Rosse to be similarly used in his 3-feet Newtonian; its μ for E=1·5321.

No. 11, of 60°, obtained at Munich in 1837. For these measures the ends were polished flat; its μ for E=1·6405.

These three show considerable progress, and an object-glass made of such materials would have a great power of transmission, though much behind the following.

No. 12 is of 90°. Its glass is from Chance; its μ for E=1·6216.

No. 13 is a cylinder 2·2 inches in diameter, and 4·3 long, which Mr. Grubb obtained from Messrs. Chance for these measures; its μ for E = 1·5200.

No. 14 is a cylinder got at the same time, 2·1 inches in diameter and 4·4 long; its μ for E = 1·6126; the ends of both are polished flat, and they are of wonderful transparency.

If, as there is good ground for hoping, Messrs. Chance shall succeed in manufacturing large disks of the same perfection as these two cylinders, the author's comparison of the achromatic and the reflector must be considerably modified.

Assuming n=·02, he calculates that the aperture of an achromatic, of focal length equal to 18 times the aperture, equivalent to a 4-feet Newtonian, is 35·435 inches. This aperture would be diminished if the process of cementing were found applicable to lenses of such magnitude.

The author concludes with suggesting that, as very slight variations in the manufacture of glass seem to make great changes in its absorptive power, it would be prudent to examine the value of n in the disks intended for lenses of any importance. This could be done by polishing a couple of facets on their edges, and need not involve the sacrifice of many minutes.

II. "Note on the Formation and Phenomena of Clouds." By John Tyndall, LL.D., F.R.S. Received January 25, 1869.

It is well known that when a receiver filled with ordinary undried air is exhausted, a cloudiness, due to the precipitation of the aqueous vapour diffused in the air, is produced by the first few strokes of the pump. It is, as might be expected, possible to produce clouds in this way with the vapours of other liquids than water.

In the course of the experiments on the chemical action of light which have been already communicated in abstract to the Royal Society, I had frequent occasion to observe the precipitation of such clouds in the experimental tubes employed; indeed several days at a time have been devoted